# GUM BASE AND CHEWING GUM CONTAINING SAME

This application is a continuation-in-part of Ser. No. 06/270,710 filed June 5, 1981, now abandoned.

## BACKGROUND OF THE INVENTION

The present invention relates to the art of chewing gum base composition and, in particular, to novel chewing gum base compositions in which desired characteristics can be achieved by unique combinations of primary components heretofor unknown.

Chewing gums, as they are known today, generally comprise a water-soluble flavor portion which is dissipated over a period of time, and a base portion which is insoluble and inert and is retained in the oral cavity throughout mastication. Depending on the intended effect of the particular chewing gum product, the base portion is composited with components selected from the effect achieved thereby and based on their compatibility.

One important component of a gum base is the elastomeric portion which, according to the present state of the art, can include natural elastomers, synthetic elastomers, or combinations thereof. This element of the gum base is important in that it provides the insoluble cud with resiliency to recover from deformation caused by chewing. In preparing gum base, it is important that other components included in the base composition which are included to effect various characteristics in the resulting chewing gum be thoroughly mixed with the elastomeric portion so that the entire cud retain proper resiliency as a homogeneous phase.

In order to achieve a homogeneous phase cud wherein a proper resiliency is constant throughout, it is necessary to provide components which are as nearly miscible with the elastomer as possible. This result is not easily attained in the gum base art because the various components must not only come together as a homogeneous mass during initial mixing but must also remain in the homogeneous state during chewing gum compounding with the water-soluble portion, during processing, e.g., gum unit production and wrapping, and while chewing. Factors such as the effect of the water-soluble components, heat, moisture, etc. must be considered in preparing a useable gum base.

Moreover, since, as in all food arts, chewing gum production is necessarily constrained by economical, processing, marketing, and safety factors, mere physical and chemical compatibility is not the only concern. So constrained, the art of making chewing gum has evolved through the years by building only on known workable combinations of useable ingredients. Consequently, in attempting to achieve a particular attribute or combination of attributes in a chewing gum, it has been necessary to utilize the component known to provide such attribute(s) in the resulting gum along with that component's accompanying compatibilizing ingredients which may detract significantly from the end product or seriously constrain the use of certain other additives such as flavorants, sweetener, antioxidants, etc. with the particular component.

When adding resinous components to elastomers problems enunciated above relative to compatibility are especially troublesome, since both elastomers and resins are polymers. The difference in the nature of an elastomer from that of a resin is, among other things, one of degree of internal mobility between polymer chains.

Both elastomers and polymeric resins inherently have a characteristic intensity of intermolecular interaction, called the cohesive-energy density, which, in general, must be overcome to some extent in order to achieve compatibility between these two types of components. Attractive forces between organic molecules, which account for the characteristic cohesive-energy density, include, among other things, Van der Waals forces, dispersion forces, dipole-dipole forces, dipole-induced dipole forces, and acid-base forces, of which the most important is hydrogen bonding. A gross measure of all such forces can be expressed as a Hildebrand solubility parameter, $\delta$, which is an expression of the solubility of a particular substance.

In theory, the miscibility of polymers relates to those having comparable solubility parameters, which is generally considered in the polymer art as those polymers having a difference in solubility parameters of less than 1.7–2.0, S. Krause, "Polymer Compatibility," *J. Macromal. Sci-Macromal. Chem* C7, pg. 251–314 (1972).

While it is known that straight mechanical shearing may be used to intimately contact polymers having disparate chemical and structural properties, such methods may also depolymerize the components thus destroying desired inherent polymeric properties such as memory (i.e. elasticity) and film forming capabilities (i.e., relative displacement without rupture of intermolecular bonding). To overcome these problems different ingredients have been used in an attempt to compatibilize resins and elastomers without total depolymerization.

In particular, the elastomer styrene-butadiene copolymer (SBR) has in the past required the use of accompanying ester gums (glycerol esters of rosin) in order to effect compatibilization with other chewing gum base components, and in order to achieve film-forming properties which is desired for bubble gum bases. The use of ester gums with styrene-butadiene has, however, been found to generate problems such as inherent oxidative instability and tackiness in the chewing gum product. Furthermore, chewing gum bases made by use of SBR and ester gums characteristically are rigid, very hard, brittle, non-chewable, and require a significant amount of energy as well as the addition of extensive amounts of softeners, fillers, etc. to achieve the proper texture for use in a chewing gum. To overcome the defects associated with the use of styrene-butadiene in combination with ester gums, those skilled in the gum art have traditionally approached the problem on a trial and error basis by incorporating additional ingredients which provide the desired characteristics in the end product.

Now, however, by use of the present invention, which contemplates proper plasticization principles applied to the external plasticization of primary gum base components, i.e., elastomer and resin, heretofor considered incompatible, a soft, inherently stable SBR gum base can be produced which also has excellent film-forming properties and is essentially non-tacky.

Similarly, with regard to polyisobutylene elastomer (PIB) it has been considered necessary to include certain accompanying ingredients to effect compatibilization with other gum base components. For example, U.S. Pat. No. 3,984,574 to Comollo discloses a gum base which includes polyisobutylene in combination with polyvinyl acetate but which also requires additional